# Case Study: Uranium Mine, Northern Saskatchewan

*Borehole Autonomous Survey System (BHASS)*

## The Challenge

A mining client required a custom autonomous system that could be used in inertial, radiometric and video probe surveys up and down vertical boreholes up to 60 meter in length. The boreholes are accessible from underground tunnels at depths of approximately 500 meters.

The system had to be ruggedized to withstand harsh mining conditions. The proposed up-hole deployment system was required to operate in pipes with uneven and corroded surfaces.

## The Need

The key requirements for the Borehole Autonomous Survey System (BHASS) included:

- An independent electro-hydraulic drive system powered either by the underground electric grid (575 VAC/43 A max) or an onboard diesel engine. The skid drive system was required so the BHASS could be used in narrower tunnels and moved without the need for other equipment.
- An up-hole deployment system using compressed air (125 psi max).
- Adequate clearance for underground tunnels to allow workers and small equipment to pass by.
- Control systems that could:
  - Operate the BHASS, including remote steering
  - Analyze and collect data from surveys
- A crew size of two operators to run the system.
- Safety features to ensure safe operation, such as an elevated platform to access boreholes, outriggers to stabilize the system, a walkway to allow operators to access the front and back of the machine in narrow tunnels; designed to meet underground mining safety codes.

## The Solution

The BHASS consists of two key subsystems: an independent electro-hydraulic drive system and a surveying system.

The BHASS drive system can be powered either by a 30 horsepower Toshiba electric motor (575VAC, 3-phase) or a diesel engine. Airless tires are driven by hydrostatic hubs with an option to skid and free wheel. In order to provide a level platform for surveys, the system is equipped with four hydraulic stabilizers. The drive system can be operated remotely via a pendent.

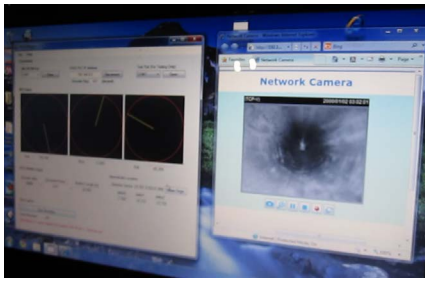
The surveying subsystem controls the deployment of various probes via an air-driven piston and its components regulate compressed air to allow for speed control. Probes are mounted on top of the piston inside the bore pipe. The pipe end is sealed and compressed air is pumped in the area between the seal and the piston. The upward movement of the piston is constrained by a wireline, which exerts a downward force on the piston. A vent tube incorporated into the piston allows for a pressure differential across the piston over the entire course of its movement.

## Associated Services

- Mechanical and Electrical Engineering: includes mechanical and electrical component design, such as frame, drive system, control systems and more
- Parts and Instrumentation Sourcing
- Machining and Assembly
- Lab and On Site Testing
- Project Management

*BHASS during surveying. Gamma probe and inertial probe were used to map this borehole. Probes were loaded into a borehole from an elevated platform located on the BHASS.*

*BHASS initial setup for surveying.*




*Left screen: data display from inertial probe on left. Right screen: Video display from a camera head mounted on top of inertial probe. Camera was used to assess mineral buildup within bore pipes.*

## CONTACT

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